is then pulled from the air port vent toward the right waste chamber vent until the fluid front reaches sensor **4***a*. Air is then pulled from the air port vent toward the left waste chamber vent until the fluid front reaches sensor **4***b*. As shown in FIG. **37**(*b*), sensors **2***a* and **2***b* are at staggered positions within their respective channels to compensate for the dead volume in fluidic junctions **3728** and **3729**; the amount of sample metered into the right and left channels is the same (although, optionally, sensor placement can be selected to meter different volumes into the two chambers). After the sample splitting process is complete air is drawn to the collection chamber vent from the air port vent to clear unused sample from the fluidic lines.

[0353] The dry reagent pills in the left and right flow chambers are rehydrated by moving the sample slugs back and forth so that the leading and trailing liquid fronts move between sensors **4***a* and **3***a* in the right channel (**3730***a*) and **4***b* and **3***b* in the left channel (**3730***b*). For one step immunoassays, the dry pill may contain labeled antibodies, in the specific case of an influenza typing/subtyping panel, the dry pill may contain a neutralizing buffer to compensate for the low pH of the extraction buffer.

[0354] Right and left ECL detection chambers **3731***a* and **3731***b* are filled with sample by pulling the respective fluid slugs until the trailing edges reach optical sensors **5***a* and **5***b*. The slugs are then moved back and forth in the channels such that the trailing edges move between sensors **5***a* and **4***a* (right) and **5***b* and **4***b* (left). This process is continued for the prescribed assay incubation time to allow binding reactions to occur at the electrodes in the detection channels. Optionally, the cycling process is stopped occasionally and i) air is pulled from the air port vent to the collection component vent to prevent any wicking of fluid out of the collection component and/or ii) the extraction reagent vent is briefly opened to ambient to prevent pressure build-up in the chamber. During back and forth movement of the sample slugs, the reader control system may monitor cycle time and use the observed timing to adjust pump speed to hit a specified fluid flow speed.

[0355] On completion of the incubation phase, the samples are cleared from the detection chambers by aspiration of air from the air port to the respective waste ports. A fluidic design with hydrodynamic matching regions is used to provide for even fluidic flow during sample clearing (see FIG. **40** and accompanying text). The wash reagent ampoule (which, for ECL assays, preferably also acts as an ECL read buffer) is then broken and the fluidic lines are primed with wash reagent by pulling wash reagent from the wash reagent chamber toward the waste chambers until optical sensors **2***a* and **2***b* detect the fluid fronts. The wash buffer is then cleared through the detection chambers by aspirating fluid toward the right waste chamber from the air port vent and then toward the left waste chamber. To carry out an air-segmented wash of a detection chamber, fluid is aspirated toward the respective waste chamber while alternating between opening the wash buffer vent and the air port vent to ambient pressure. This segmented wash slug is generated until sensor **5***a* (right chamber) or **5***b* (left chamber) detects the fluid front. The prepared air-segmented slug is then pulled through the detection chamber and cleared by aspirating toward the respective waste chamber while opening the air port vent to ambient pressure. This process is repeated a pre-determined number of times (e.g., twice) for each detection chamber.

[0356] To fill the detection chambers with the wash/read buffer for an ECL measurement, the wash buffer fluid front is first pulled back towards the read buffer chamber while opening the air port vent to ambient. The wash buffer is then metered by applying pressure to the wash buffer chamber vent and moving fluid toward the waste chamber vents until optical sensors **2***a* and **2***b* detect the fluid front. The tail of the slug is pulled into the collection component after connecting the air port vent to ambient. The slug in the right channel is then moved into the right detection chamber by aspirating toward the right waste chamber while opening the airport vent to ambient until optical sensor **5***a* detects the trailing edge of the metered slug. The slug in the left channel is then moved into the left detection chamber by aspirating toward the left waste chamber while opening the airport vent to ambient until optical sensor **5***b* detects the trailing edge of the metered slug. Optionally, the control electronics checks for the presence of bubbles in the fluid slugs by looking for transient changes in the signal at optical sensors **4***a* or **4***b* that are followed by a similar change in the signal at optical sensors **5***a* or **5***b*, respectively, where the timing of the changes is consistent with the flow rate of the fluid slugs.

[0357] Once the wash/read buffer has been positioned into the detection chambers, ECL analysis is carried out. The photodiode is aligned with an assay electrode in one of the two detection chambers, the appropriate electrical potential is applied to the electrode (preferably, using an adjacent electrode as the counter electrode) and the resulting ECL is measured. By translating the cartridge tray, each assay electrode in the chamber may be aligned with the photodiode and analyzed in a serial fashion. Preferably, after each electrode is analyzed, it is used as the counter electrode for analyzing the adjacent electrode (as described above). When analysis of one channel is complete, the photodiode is shuttled into alignment with the other channel using the photodiode shuttling mechanism described in FIGS. **45** and **46** and the accompanying text. ECL is then induced and measured from the electrodes in the second channel as described for the first channel. Optionally, after ECL analysis is complete, the photodiode is shuttled back to its original position.

[0358] Subsequent to ECL analysis, the fluids in the channels may be aspirated into their respective waste chambers and the cartridge tray is extended, allowing the user to remove the cartridge. Assay results are then displayed on the GUI and may also be saved to memory and/or transferred to a network or server. In one embodiment of the invention, the cartridge contains assays for i) detection and typing influenza (for example, assays for influenza nucleoproteins or matrix proteins or other proteins that show high degrees of conservation across an influenza type) and ii) assays for specific influenza subtypes (e.g., assays for specific hemagglutinin or neuraminidase subtypes). Optionally, the typing and subtyping assays are separated into different channels of the cartridge. The ECL signals that are generated are compared to assay thresholds (which may be provided as lot specific parameters) and the GUI reports samples with signals above the thresholds as being positive for the respective influenza type or subtype. In one specific embodiment, the subtyping assays are assays for different influenza A hemagglutinin subtypes and the GUI only reports subtyping results if the typing result is positive for influenza A.

[0359] The assay modules (preferably assay cartridges) of the invention may be used to carry out a variety of different assay formats for measuring analytes interest, preferably formats based on electrode induced luminescence measurements. The assays, preferably, comprise the steps of introduc-